

**A FIRST RECORD OF *APTILOTUS* MIK (DIPTERA: SPHAEROCERIDAE)
FROM THE NEOTROPICAL REGION, WITH THE DESCRIPTION OF
THREE NEW WINGLESS SPECIES OF THE *APTILOTUS PARADOXUS*
GROUP FROM HIGH ELEVATIONS IN COSTA RICA**

S. A. MARSHALL

Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada
N1G 2W1.

Abstract.—The genus *Aptilotus* Mik is recorded from the Neotropical Region for the first time. *Aptilotus nigritiba*, new species, *A. nigrimera*, new species, and *A. zumbadoi*, new species, all completely wingless, are described from ca. 3,000 m in Costa Rica. A key to the Costa Rican *Aptilotus* is provided.

Key Words: Diptera, Sphaeroceridae, Limosininae, wing loss, zoogeography, taxonomy, Costa Rica

The genus *Aptilotus*, named for the single wingless European species, *A. paradoxus* Mik, is a primarily Holarctic group in which wing reduction has occurred independently within at least five lineages (Marshall 1983, Marshall and Smith 1990). Twelve described species of *Aptilotus* are Nearctic, one species is described from Europe, one is described from Ethiopia, four are from Nepal, two are from southeast Asia, and a group of seven closely related species are restricted to the Canary Islands. There were no known Neotropical *Aptilotus* prior to the discovery of the three new wingless species described herein, all of which are endemic to high elevation sites in Costa Rica.

Aptilotus species can be apterous, brachypterous, or polymorphic for wing development, with aptery having evolved independently in each of the species groups recognized by Marshall (1983). The genus can be diagnosed by the following characters: male with a translucent, usually quadrate posteromedial lobe

on sternite 5; body usually black, shining and punctate; female tibia with only an apical bristle; dorsocentral bristles in 2 pairs but anterior pair often small; surstylus of characteristic shape, divided into an outer setose part and an inner part with 1 or (usually) 2 stout bristles.

All known Central American *Aptilotus* can be distinguished from other wingless Central American Sphaeroceridae not only by the defining characters of *Aptilotus* as outlined above, but also by the plesiomorphic possession of two orbital bristles. Other wingless Central American sphaerocerids, most of which belong to the genus *Pterogramma*, have only a single orbital bristle.

RELATIONSHIPS

The species described here belong to the *paradoxus* group of Marshall (1983) with which they share the following synapomorphies: distiphallus elongate, comprised of distinctive dorsal and ventral loops and a broad, bilobed membranous

and microspinulose apex; outer posterior part of surstylus long-setose; anterior surstylar spur characteristically flattened, often scale-like. Delimited on the basis of these characters, the *paradoxus* group includes a clade of 6 brachypterous and one macropterous species restricted to the Canary Islands (*A. beckeri* and related species), an apterous European species (*A. paradoxus* Mik), three macropterous species from Nepal (*A. glabrifons* Marshall, *A. spinistylus* Marshall, *A. rufiscapus* Marshall), two macropterous eastern North American species (*A. pogophallus* Marshall and *A. nigriphallus* Marshall), a macropterous species in Japan (*A. longinervis* Hayashi), a dimorphic western North American species (*A. luctuosus* (Spuler)) and two brachypterous western North American species (*A. nigriscapus* Marshall, *A. luteoscapus* Marshall). The new Costa Rican species all seem to be closely related to a clade including European and western North American species which have relatively short female cerci and quadrate, bilobed posteromedial areas on male sternite 5.

Although all *Aptilotus* exhibit an unusual degree of morphological uniformity, the Costa Rican species seem to represent a distinct clade, weakly supported on the basis of the shape of sternite 5 of the male, the sclerotized part of which is very short medially, and sternite 8 of the female, which is reduced and modified. Within the Costa Rican *Aptilotus* clade, *nigrimera* plus *zumbadoi* form a monophyletic group, strongly supported by the possession of a third surstylar bristle and the loss of bristles from tergite 9 of the female.

DISCUSSION

All of the species described here were collected on Cerro de la Muerte, at a cold paramo-like site at 3300 m, or in high elevation forests (2600 m and above) within a few kilometres of Cerro de la Muerte. Although it seems likely that related species occur, or previously occurred, at oth-

er relatively high elevation sites in the intervening area, current data show a disjunction between the cluster of endemic *Aptilotus* in Costa Rica and their nearest relatives in western North America. Other high elevation collections in Costa Rica have yielded wingless Sphaeroceridae, but only in primarily Neotropical clades related to *Pterogramma* Spuler. Similarly, sphaerocerid samples available from leaf litter collections from other high-elevation Central American sites have included a diversity of undescribed *Pterogramma* but no *Aptilotus*. Habitat at these sites ranged from mixed oak-pine forests at 2800 m (Oaxaca, Mexico) to high elevation cloud forests at elevations from 2300–2800 m (Chiapas, Mexico; Quezaltenango, Guaemala; El Salvador; Cerro Chiriqui, Panama). Also, no South American *Aptilotus* are known, despite collection efforts in apparently suitable habitat in the paramos of Ecuador and Venezuela.

Despite the lack of Mexican and Central American records outside Costa Rica, further sampling at higher elevations than those sites from which samples are currently available are likely to reveal additional *Aptilotus* species. It is hypothesized that *Aptilotus* is a primarily northern group, present in the Neotropical region as far south as lower Central America (but not into South America), where it exhibits a highly disjunct distribution restricted to cool temperate conditions at elevations above 2500 m.

KEY TO THE COSTA RICAN SPECIES OF *APTILOTUS*

1. Legs mostly black, trochanters and mid and hind tarsi brown; antenna black. Female sternite 8 very small, transverse (Fig. 14). Female tergite 9 with two bristles (Fig. 16). Surstylus with 2 short, thick ventral bristles (Fig. 11) *Aptilotus nigriritbia*, n. sp.
- Legs luteous, antenna variable. Female sternite 8 with an elongate anterior portion (Figs. 6, 22). Female tergite 9 bare (Fig. 8). Surstylus with 3 short, thick ventral bristles (Figs. 4, 20) 2

2. Antenna black, legs mostly luteous. Part of frons and body bare and shining. Middle ventral surstylar bristle inserted close to posteroventral surstylar bristle (Figs. 1, 4)
 *Aptilotus nigrimera*, n. sp.
- Antenna and legs mostly luteous. Frons and body entirely pruinose, without shining areas. Middle ventral surstylar bristle mid way between anteroventral and posteroventral surstylar bristle (Figs. 17, 20) . . . *Aptilotus zumbadoi*, n. sp.

DESCRIPTIONS OF COSTA RICAN *APTILOTUS*

Aptilotus nigrimera Marshall, NEW

SPECIES

(Figs. 1–8)

Description.—Body length 2.5–3.0mm. Body shining black; fore tarsus pale brown, legs otherwise yellow; antenna black to dark brown. Middle part of frons mostly bare and shining, ocellar triangle setulose but flanked by bare areas, interfrontal area with only a few setulae medially. Interfrontal bristles in 2–3 thin, subequal pairs. Eye height 4.0× genal height. Dorsocentral bristles in two postsutural pairs, anterior pair only slightly longer than acrostichal setulae, prescutellar pair long; only 2–3 rows of acrostichal setulae between dorsocentral areas. Scutellum almost transverse, twice as wide as long. Mid tibia with a long anterodorsal bristle proximally, a long distal dorsal bristle, and short anterodorsal and posterodorsal distal bristles. Ventral surface of tibia with only an apical bristle in both sexes. Wing and halter completely absent.

Male abdomen.—Tergite 1+2 longer than other tergites, uniformly dark. Sternite 5 with anterior and posterior margins strongly curved, anterior margin with shallow medial notch; posteromedial pale part of sternite extending back to anterior margin of sternite so that pigmented part of sternite is very short medially, pale posteromedial section with brown pigmentation medially, rounded and narrowly notched posteromedially; pale area flanked by clusters of bristles. Surstylus broad, with thin bristles on a posterolateral bulge or ridge and 3 thick ventral bristles; a flattened, broadly bifid anteroventral bristle, a short,

thick posteroventral bristle and a long, thick ventral bristle inserted much closer to posteroventral than anteroventral bristle. Gonostylus almost parallel sided, thick, distal part tapered. Basiphallus short, quadrate. Distiphallus with dorsal (functionally ventral) sclerite with a broad basal part, a narrow intermediate section and a distally forked part; ventral sclerite with a broad base and broad distal loop; membranous part of distiphallus with long distal dorsal lobes covered with flattened setulae.

Female abdomen.—Tergite 8 black, long, with a shallow anterior notch. Tergite 9 pale, with a short, transverse, anterior part and a large posterior part narrowly fused with cerci, surface bare (the usual 2 bristles absent). Cerci pale, shorter than tergite 9. Sternite 8 long and narrow, posterior part slightly enlarged with 4 small bristles. Sternite 9 broad, setulose except lateral extremes. Two internal vaginal sclerites present in addition to large, thin-rimmed rings joined by a discontinuous transverse piece (spectacles-shaped sclerite of Roháček, 1983). Spermathecae spherical, sclerotised parts of ducts slightly longer than spermathecal body.

Types.—Holotype (♂, INBio) and 5 paratypes (3♂, 2♀, GUE): COSTA RICA. Cartago Province, km. 89 Highway 2, Cerro de la Muerte, 10.ii.1995, aspirated among bamboo litter, S.A. Marshall. Paratype (♂, GUE) same as above, but sifted by R.S. Anderson.

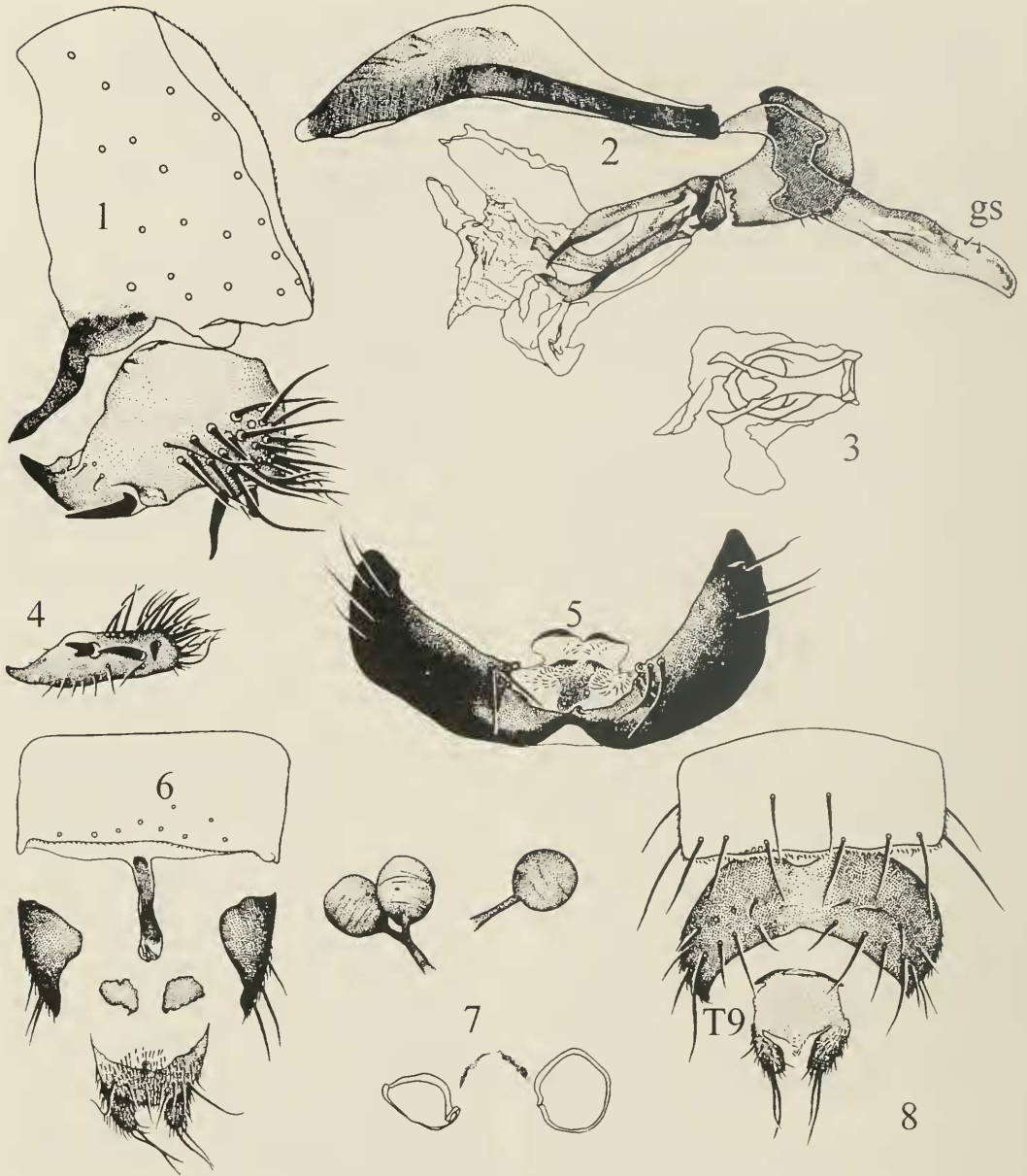
Etymology.—The specific epithet refers to the dark antenna, a diagnostic character separating *A. nigrimera* from the closely related *A. zumbadoi*.

Aptilotus nigriritibia Marshall, NEW

SPECIES

(Figs. 9–16)

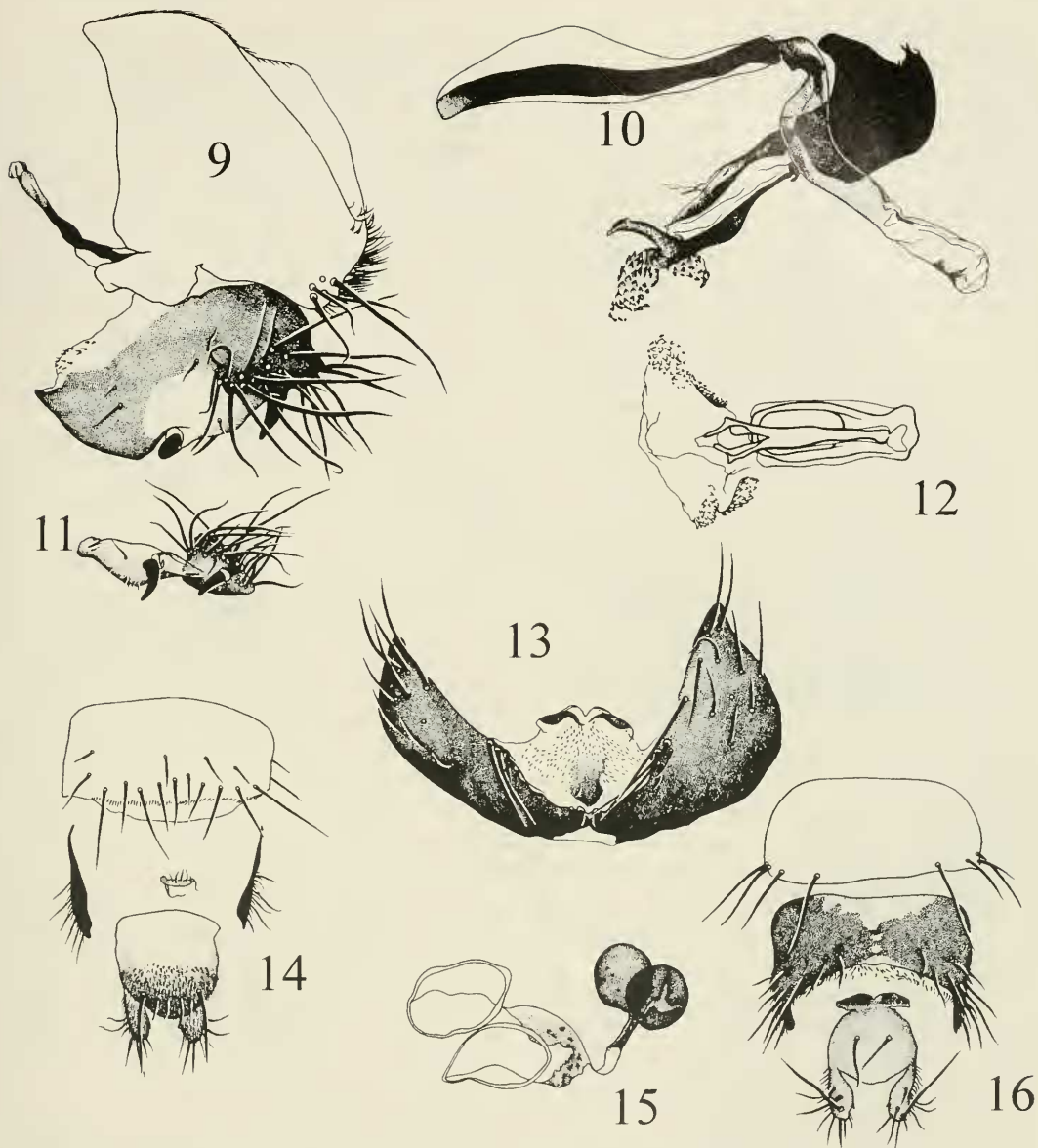
Description.—Body length 2.0–2.5mm. Body almost entirely heavily pruinose, black; fore tibia and tarsi black, other tarsi brown, legs otherwise yellow; antenna yellow to pale brown. Head entirely pruinose, without shining areas. Interfrontal bristles



Figs. 1-8. *Aptilotus nigrimera*. 1, Male terminalia, left lateral. 2, Aedeagus and associated structures, left lateral. 3, Distiphallus, ventral view. 4, Surstylus, ventral view. 5, Sternite 5 of male. 6, Female terminalia, ventral. 7, Spermathecae and associated sclerites. 8, Female terminalia, dorsal. Abbreviations: gs = gonostylus (paramere of earlier papers); T9 = tergite 9 (epiproct of earlier papers).

in 2-3 thin, subequal pairs. Eye height $4.5 \times$ genal height. Dorsocentral bristles in two postsutural pairs, anterior pair twice as long as acrostichal setulae, prescutellar pair

much longer; 4 rows of acrostichal setulae between dorsocentral areas. Scutellum almost transverse, twice as wide as long. Mid tibia with a long anterodorsal bristle prox-



Figs. 9–16. *Atilotus nigritibia*. 9, Male terminalia, left lateral. 10, Aedeagus and associated structures, left lateral. 11, Distiphallus, ventral view. 12, Surstylus, ventral view. 13, Sternite 5 of male. 14, Female terminalia, ventral. 15, Spermathecae and associated sclerites. 16, Female terminalia, dorsal.

imally, a long distal dorsal bristle, a short anterodorsal distal bristle and a smaller posterodorsal distal bristle. Ventral surface of tibia with only an apical bristle in both sexes. Wing and halter completely absent.

Male abdomen.—Tergite 1+2 longer than other tergites, uniformly dark. Sternite 5 with anterior and posterior margins

strongly curved, anterior margin with shallow anteromedial notch; posteromedial pale part of sternite extending back to anterior margin of sternite so that pigmented part of sternite is very short medially; pale posteromedial section with brown pigmentation medially, rounded and narrowly notched posteromedially; pale area flanked by clus-

ters of bristles. Surstylus broad, with thin bristles on a posterolateral bulge or ridge and 2 thick ventral bristles; a flattened anteroventral bristle and a short, thick posteroventral bristle; a very small ventral bristle inserted close to posteroventral bristle. Gonostylus of medium width and weakly S-shaped, distal part expanded. Basiphallus short, quadrate. Distiphallus with dorsal (functionally ventral) sclerite with a broad basal part, a narrow intermediate section and a distal loop which is not closed distally; ventral sclerite with a broad base and broad distal loop; membranous part of distiphallus with long distal dorsal lobes covered with conspicuous flattened setulae.

Female abdomen.—Tergite 8 black, long, with a shallow anterior notch. Tergite 9 pale, with a short, transverse, anterior part and a large posterior part narrowly fused with cerci and with 2 dorsal bristles. Cerci pale, shorter than tergite 9. Sternite 8 small, transverse, with 4 small bristles. Sternite 9 broad, setulose except lateral extremes. Indistinct vaginal sclerites present in addition to large, thin-rimmed rings joined by a discontinuous transverse piece (spectacles-shaped sclerite of Roháček 1983). Spermathecae spherical, sclerotised parts of ducts slightly longer than spermathecal body.

Types.—Holotype (δ , INBio) and 2 paratypes (1 δ , 1 f , GUE): COSTA RICA: Cartago Province, km. 89, Highway 2, Cerro de la Muerte, 10.ii.1995, aspirated among bamboo litter, S.A. Marshall.

Etymology.—The specific epithet refers to the black tibia which differentiates *A. nigritibia* from Costa Rican congeners.

Aptilotus zumbadoi Marshall, NEW

SPECIES

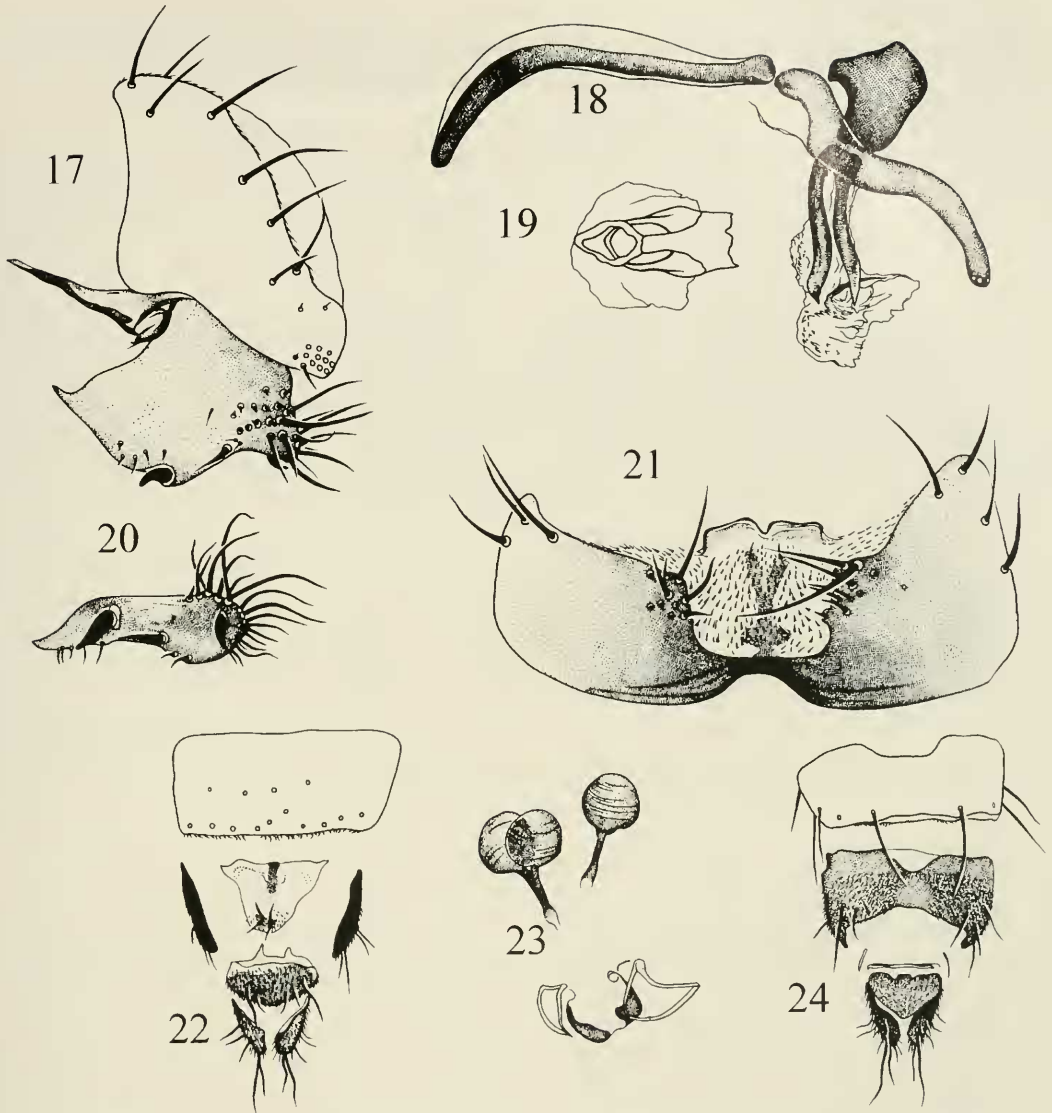
(Figs. 17–24)

Description.—Body length 2.0–2.5mm. Body almost entirely heavily pruinose, black; fore tibia and tarsi black, other tarsi brown, legs otherwise yellow; antenna yellow to pale brown. Head entirely pruinose, without shining areas. Interfrontal bristles

in 2–3 thin, subequal pairs. Eye height 4.5 \times genal height. Dorsocentral bristles in two postsutural pairs, anterior pair twice as long as acrostichal setulae, prescutellar pair much longer; 4 rows of acrostichal setulae between dorsocentral areas. Scutellum almost transverse, twice as wide as long. Mid tibia with a long anterodorsal bristle proximally, a long distal dorsal bristle, a short anterodorsal distal bristle and a smaller posterodorsal distal bristle. Ventral surface of tibia with only an apical bristle in both sexes. Wing and halter completely absent.

Male abdomen.—Tergite 1+2 longer than other tergites, uniformly dark. Sternite 5 of uniform length, neither anterior nor posterior margin strongly curved, anterior margin with broad medial notch; posteromedial pale part of sternite extending back almost to anterior margin of sternite, with elongate brown pigmentation medially, quadrate and narrowly notched posteromedially; pale area flanked by clusters of bristles. Surstylus broad, with thin bristles on a posterolateral bulge or ridge, and 3 thick ventral bristles; a flattened anteroventral bristle, a short, thick posteroventral bristle and a ventral bristle midway between the other two. Gonostylus thin, of uniform width and weakly S-shaped. Basiphallus short, quadrate. Distiphallus with dorsal (functionally ventral) sclerite with a broad basal part, a narrow intermediate section and a distal loop; ventral sclerite with a broad base and broad distal loop.

Female abdomen.—Tergite 8 long, bare and shining medially and anteriorly, with a shallow anterior notch. Tergite 9 pale, with a short, transverse, anterior part and a large posterior part narrowly fused with cerci, surface bare (the usual 2 bristles absent). Cerci slightly longer than tergite 9. Sternite 8 long and narrow, posterior part separate from long and narrow part, with 4 small bristles. Sternite 9 broad, setulose except lateral extremes. Indistinct internal vaginal sclerotisation present in addition to large, thin-rimmed rings joined by a broad sclerite (spectacles-shaped sclerite of Roháček



Figs.17-24. *Aptilotus zumbadoi*. 17, Male terminalia, left lateral. 18, Aedeagus and associated structures, left lateral. 19, Distiphallus, ventral view. 20, Surstylus, ventral view. 21, Sternite 5 of male. 22, Female terminalia, ventral. 23, Spermathecae and associated sclerites. 24, Female terminalia, dorsal.

1983). Spermathecae spherical, sclerotised parts of ducts slightly longer than spermathecal body.

Types.—Holotype (δ , INBio) and 3 paratypes (2 δ ,1 ♀ ,GUE): COSTA RICA: Cartago Province, km. 89, Highway 2, Cerro de la Muerte, 10.ii.1995, aspirated among bamboo litter, S.A. Marshall.

Paratypes.—COSTA RICA. Cartago Province, 2kmS Villa Mills, 3000m,

10.ii.1996, ridge top mature oak forest litter, R.S. Anderson (1 δ ,2 ♀ ,GUE); San Jose Province, km. 68 Highway 2, Tres de Junio Bog, 2600m, 10.ii.1996, litter from forest adjacent to Sphagnum bog, R.S. Anderson (2 δ ,GUE); Cerro de la Muerte, 7-13.iv.1985, pan traps, oak cloud forest, L. Masner and H. Goulet (1 δ ,GUE); km. 95, Highway 2, 3200m, 13.iv.1985, oak cloud forest, L. Masner (1 δ , GUE).

Etymology.—The specific epithet is a patronym in recognition of INBio's Diptera specialist, Manuel Zumbado. Without Manuel's help we could not have made collections at the type localities for this and other species described here.

ACKNOWLEDGMENTS

Dr. Robert Anderson, Canadian Museum of Nature, provided specimens, advice concerning high altitude insects of Central America, and company in the field. Manuel Zumbado, Instituto Nacional de Biodiversidad (INBio), Costa Rica, provided invaluable advice and field support. Rebecca

Langstaff did the illustrations. Paratypes are retained in the University of Guelph Insect Collection (GUE).

LITERATURE CITED

- Marshall, S. A. 1983. A revision of the genus *Aptilonus* Mik in North America (Diptera; Sphaeroceridae). *Canadian Journal of Zoology* 61: 1910–1924.
- Marshall, S. A. and I. P. Smith 1990. A review of the North American species of *Aptilonus*, with descriptions of new species from North America and Nepal (Diptera; Sphaeroceridae). *Canadian Journal of Zoology* 68: 2338–2351.
- Roháček, J. 1983. Monograph and reclassification of the previous genus *Limosina* Macquart (Diptera, Sphaeroceridae) of Europe. *Beiträge zur Entomologie*, Berlin 33: 3–195.